

Radon solubility in different types of tissue*

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Introduction

Low doses of ionizing radiation are used for therapy of inflammatory diseases like rheumatoid arthritis. Clinical studies show an increased mobility and less pain of such patients after therapy especially with radon [1]. But the molecular mechanism and the genetic risk of this therapy are not known in detail.

To investigate the effects of radon and its daughter nuclei we studied the radon uptake and the chemical path in different tissues and in mice.

Measurement Setup

For these studies we constructed a Radon exposure chamber that enables to expose samples at various conditions including those of the radon galleries. All parameters like temperature, humidity and radon concentration are permanently monitored and controlled.

To measure the radon kinetics in different types of tissue we exposed tissue samples in the radon chamber and measured the γ -spectrum of the radon decay products in the exposed samples with a HPGe-detector. In our measurements it was possible to distinguish the short living decay products Pb-214 and Bi-214. We recorded the spectra at different time points after exposure and compared the results from different types of tissue like fat or muscle but also activated coal.

Results

In an activated coal sample the decay kinetics are governed by the long life time of the radon (3,8 days) because it is bound via Van-der-Waals force as shown in fig. 1.

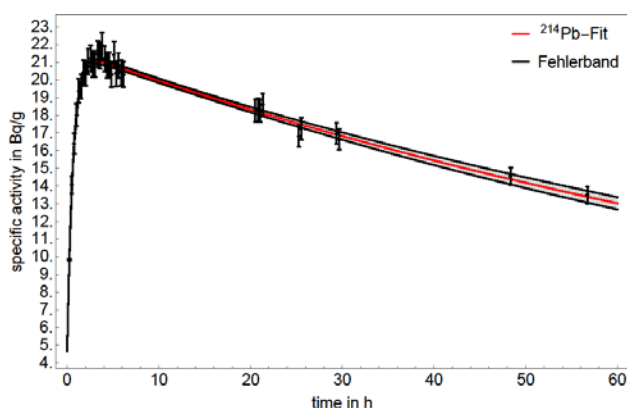


Fig. 1: Measured γ -activity of Pb-214 over 57 hours in an activated coal sample

But in the biological samples the primary radon diffuses out of the samples and the spectra follow the kinetics of the decay of the daughter products. Therefore in the

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data analysis their radioactive decay has to be combined with a diffusion term for the primary radon.

In fig. 2 a typical measurement with a biological sample is given. The time between two measuring points was 900 s. After two to four hours the measurements were stopped, since the activity reached detection limit.

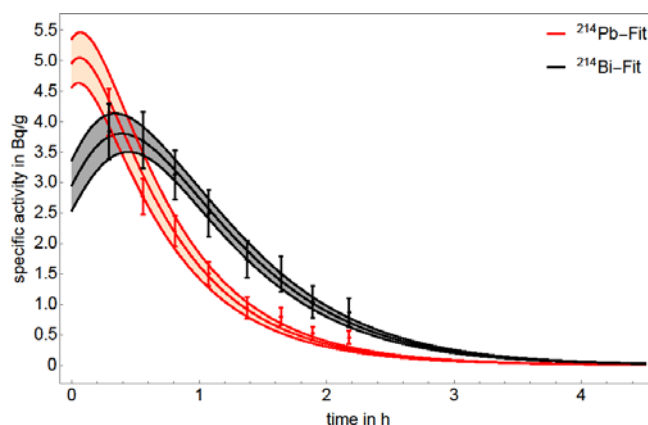


Fig. 2: Measured γ -activity of Pb-214 and Bi-214 over four hours in a tendon sample

With the results from the activities of Pb-214 and Bi-214 we could calculate the initial amount of radon in our sample directly at the beginning of our measurement.

Discussion

In our first measurements we exposed different types of tissue like muscle, fat or tendon. We developed an analysis model and optimized the γ -spectroscopy for the low activities in our samples.

In the future we want to repeat these experiments for better statistics and measure additional types like bone or cartilage. For this we ordered a new detector which we will commission in the following month.

References

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